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SERVICE AND REGULATORY ANNOUNCEMENTS NO. 147¹

METHODS FOR DETERMINING MOISTURE CONTENT AS SPECIFIED IN THE OFFICIAL GRAIN STANDARDS OF THE UNITED STATES AND IN THE UNITED STATES STANDARDS FOR BEANS, PEAS, LENTILS, AND RICE²

The use of airtight containers to protect the samples of grain and other commodities from losing or gaining moisture before the moisture test is made, and the careful handling of the samples is necessary if the moisture test results are to be authentic. Samples that are to be tested for moisture content should not be unduly exposed to the air before grinding (if grinding is required); and it is even more important that any ground material be properly protected to prevent any change in moisture content. When samples of these commodities have been thoroughly dried, they are extremely hygroscopic, even at 130° C. Therefore moisture dishes must be covered and desiccated immediately upon removal from the oven.

In making moisture determinations an analytical balance should be used and all weighings should be made to the nearest 0.1 mg.

APPARATUS

Moisture dishes.—Moisture dishes should be made of heavy gage aluminum so that they will not dent readily. They should have a diameter of about 55 mm., a height of about 15 mm. with slightly tapered sides and be provided with tightly fitting slip-in covers which are designed to fit snugly under the dishes when they are placed in the oven. Both the dish and its cover should be identified by the same number. (Moisture Dishes, Special, Precision, No. 1631, are available from Fisher Scientific Co.)³ Before using a moisture dish, it should be dried for 1 hr. at 130° C. or by an equivalent drying procedure, cooled in a desiccator, and the tare weight obtained.

Desiccator.—Desiccator should be airtight and should contain activated alumina, "Molecular Sieves" (a product of Linde Air Products Co.),³ or other equally suitable desiccant. Reignited quicklime, silica gel, and anhydrous calcium chloride are not suitable desiccants.

Oven.—Oven may be of gravity-convection or mechanical-convection (forced draft) type. It should be well insulated and maintain a reasonably uniform temperature throughout the chamber and be capable of being maintained at the desired temperature at the shelf level of the samples. The oven should be properly ventilated and equipped with a suitable thermometer accurate to within 0.5° C., and with removable perforated or wire shelves.

Mill.—The mill should be of a type that is capable of grinding the sample without undue exposure to the atmosphere and without appreciable heating, so as to avoid possible gain or loss of moisture. (Wiley Laboratory Mill, Intermediate Model⁴ is satisfactory for this purpose.)

¹ This announcement was originally issued as Service and Regulatory Announcements No. 147 of the Bureau of Agricultural Economics.

² a. Official Grain Standards of the United States. SRA-AMS-177.

b. United States Standards for Beans. 7 CFR, 68.101-103.

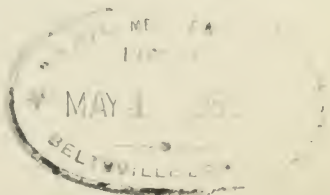
c. United States Standards for Dry Peas. 7 CFR, 68.401-403.

d. United States Standards for Split Peas. 7 CFR, 68.501-503.

e. United States Standards for Lentils. 7 CFR, 68.601-603.

f. United States Standards for Rough Rice, Brown Rice, and Milled Rice. 7 CFR, 68.201-203, 68.251-253, and 68.301-303.

³ The mention of firm names or trade products does not imply that they are endorsed or recommended by the Department of Agriculture over other firms or similar products not mentioned.



AIR-OVEN (130° C.) METHOD FOR WHEAT, BARLEY, OATS, RYE, GRAIN SORGHUMS, SOYBEANS, PEAS, LENTILS, AND RICE

DETERMINATION A (one-stage procedure) ⁴

Grind a representative 10- to 15-gm. portion of the original sample so that all the ground material will pass through an 18-mesh wire sieve. Certain types of mills heat the sample during grinding, and such mills should not be used unless the mill is permitted to cool between grindings. The ground sample should pass directly from the mill into a suitable container not much larger than necessary to hold the sample.

Immediately after grinding, place representative portions (duplicates at least) of approximately 2 to 3 gm. each of the ground, well-mixed sample into tared moisture dishes. Immediately cover the dishes containing the portions of the samples and weigh. Subtract the weight of each dish from the total weight and record the result as the weight of the sample. Uncover the dishes and place them with covers beneath in the oven regulated to $130^{\circ} \pm 1^{\circ}$ C. All moisture dishes should be placed on a single shelf in the oven with the bulb of the oven thermometer on the same level and as close as possible to the dishes.

After heating the material for 1 hour (timing the interval from the time when the oven reaches 130° C. *after* the insertion of the dishes), remove the shelf containing the dishes, cover the dishes immediately and transfer them to a desiccator. Weigh the dishes when they reach room temperature. Determine the loss in weight as moisture. Calculate the percentage of moisture by dividing the loss in weight due to heating by the weight of the original sample and multiplying by 100. Replicate determinations should check within 0.2 percent moisture.

DETERMINATION B (two-stage procedure)

Fill two or more tared moisture dishes nearly full with representative portions of the unground sample, the moisture content of which is to be determined. Weigh each covered dish including its contents. Subtract the weight of the dish from the total weight and record the result as the weight of the sample.

Uncover the dishes and place them with covers beneath in a warm, well-ventilated place (preferably on top of the heated oven) so that the sample will dry reasonably fast and reach approximately an air-dry condition. This usually may be accomplished in from 14 to 16 hours when the top of the heated oven is used for this preliminary drying. In all cases, except for soybeans, the moisture content must be reduced to 16 percent or less (10 percent in the case of soybeans) in this first stage.

Cover the metal dishes containing the air-dried samples and weigh each of them soon after they reach room temperature. Determine the loss in weight of the sample and record it as the moisture loss that is due to air drying. Using the air-dried sample, proceed in the manner described under Determination A.

⁴ This procedure may be used on all samples believed to contain 16 percent or less of moisture. If, after oven trials, the sample shows more than 16 percent of moisture, the two-stage procedure described under Determination B must be followed. In the case of soybeans, all samples having more than 10 percent of moisture should be tested by the two-stage procedure.

Calculate the percentage of moisture in the original sample according to the method indicated in the following example:

1. Weight of the portion of the original sample used for the test (A)----- 27.2358 gm.
2. Weight of the portion after air drying (B)----- 25.1836 gm.
3. Moisture loss due to air drying (C)----- 2.0522 gm.
4. Weight of the subportion of the air-dried sample used for the 130° C. air-oven drying (D)----- 2.8753 gm.
5. Loss of moisture due to oven drying (E)----- .2974 gm.
6. Calculate the moisture content by substitution in the equation:

$$\% \text{ moisture} = \frac{\frac{EB}{D} + C}{A} \times 100$$

$$\% \text{ moisture} = \frac{\frac{0.2974 \times 25.1836}{2.8753} + 2.0522}{27.2358} \times 100 = 17.10\%$$

Replicate determinations should check within 0.2 percent moisture.

AIR-OVEN (103° C.) METHOD FOR CORN AND BEANS

Place approximately 15 gm. of a representative portion of the unground sample in each of two or more tared moisture dishes. Weigh the covered dishes and contents. Subtract the weight of each dish from the total weight and record the result as the weight of the sample.

Uncover the dishes and place them with covers beneath for 72 hrs. in the oven regulated at 103°±1° C. The dishes should be placed on a single shelf with the bulb of the oven thermometer as close as possible to them. At the end of the heating period, remove the shelf containing the dishes, cover the dishes immediately and place them in a desiccator. Weigh the dishes when they reach room temperature. Determine the loss in weight as moisture and calculate the percentage of moisture by dividing the loss in weight due to heating by the weight of the original sample and multiplying by 100. Replicate determinations should check within 0.2 percent moisture.

AIR-OVEN (103° C.) METHOD FOR FLAXSEED

Place 5-7 gm. of a representative portion of the flaxseed into each of two or more tared moisture dishes. Weigh the covered dishes and contents. Subtract the weight of each dish from the total weight and record the result as the weight of the sample.

Uncover the dishes and place them with covers beneath for 4 hrs. in the oven regulated at 103°±1° C. The dishes should be placed on a single shelf with the bulb of the oven thermometer as close as possible to them. At the end of the heating period, remove the shelf containing the dishes, cover the dishes immediately and place them in a desiccator. Weigh the dishes when they reach room temperature. Determine the loss in weight as moisture and calculate the percentage of moisture by dividing the loss in weight due to heating by the weight of the original sample and multiplying by 100. Replicate determinations should check within 0.2 percent moisture.

